Sabine, 3.58; and coastal plains, 1.09. In January the averages varied from a minimum of 0.23 inch for the lower Guadalupe to a maximum of 0.71 inch for the Neches.

RIVER CONDITIONS.

The streams of the district generally averaged higher than during the preceding month, but there was very little change until after the middle of the month. On the 18th sharp rises occurred in the upper Colorado, and on the 21st in the upper Brazos and upper Trinity. The Colorado rise was felt throughout its length, and the stages reached, although below flood stage, are the highest on record for February. The Trinity and Brazos rises did not show up much in the lower portions of these streams. The Brazos, however, rose higher in its upper and middle portions than in any previous February since 1903.

SNOWFALL IN THE MOUNTAINS.

There was much snowfall during the month, and the prospects for irrigation water are decidedly more favorable than at any previous time this season. The accumulated depth of snow over the headwaters of the Rio Grande and Rio Pecos at the close of the month was greater in many localities than during the corresponding period of the previous year. The following extracts from reports of Weather Bureau officials furnish special information on the snowfall conditions in these drainage basins:

Colorado.—The latter half of February was stormy, and valuable additions to the stock of snow in the mountains were made on all watersheds, notably on the Rio Grande. A considerable excess was general in the Rio Grande drainage basin and over the adjacent small watersheds. As a whole, the snow is solidly packed on the western slope and loosely packed on the eastern slope.

Comparing the depths on the ground at the end of the month, the average for the snow scales on the Rio Grande, 30 inches, is 5 inches more than a year ago. For the early part of the irrigation season, about the normal flow is indicated.—*F. H. Brandenburg, district forecaster.*

New Mexico.—Very general and heavy snowfall occurred over the Rio Grande watershed during the last half of February, and a large amount of accumulated snow is reported over the headwaters of this stream, and thence southward to central New Mexico, while the southern districts generally had heavy rain. An excess in precipitation also occurred in January, with small run-off, so that the soil is well filled with moisture and the water outlook is greatly improved. Early water will be abundant and the prospect is promising.

General and fairly heavy snow occurred over the mountain districts in the Rio Pecos watershed, and over the plateau and some of the plains country, while good rains were general over the lower levels and the southern latitudes. The soil is now well filled with moisture and the outlook greatly improved. The main stream and some of the tributaries will have a good early flow, but seasonal rains will be needed to continue it far into the irrigation season.—*C. E. Linney, section director.*

MISCELLANEOUS.

Alvin.—Every new shoot was killed by the frost of the 22d and 23d.

Big Springs.—Farmers say they have the finest season, for this time of the year, they ever have had.

Bowie.—The cold wave of the 19th to 24th killed nearly all fruit which was in blossom.

Cameron.—The cold spell of the 23d and 24th killed part of the vegetable crop and about 20 per cent of the fruit.

Cuero.—The cold wave of the 23d and 24th killed some vegetables and some of the young corn that was up.

Gorham.—The top soil is in fine condition for the planting of crops, but the moisture is very shallow and a great deal more rain is needed.

Grand Saline.—Most of the fruit was killed by the severe freeze of the 19th and 20th.

Hondo.—The severe weather of the 23d and 24th did great damage to fruit, figs, etc.

Lagrange.—The killing frost of the 21st to 24th did considerable damage to blooming fruit trees.

Ricardo.—The cold snap, commencing as it did after unusually mild and growing weather, was very damaging to cucumbers, okra, squash, melons, and other early tender vegetables.

BRAZOS RIVER OVERFLOWS AND LEVEE PROTECTION.

By W. W. DIBRELL, Levee Engineer, U. S. G. S.

The recent awakening of the landowners of the Brazos bottoms to the fact that large areas of this land can be protected at a small expense by the construction of levees has attracted public attention to a certain extent, but as yet the general public has no accurate idea of the immense value of the agricultural lands of the Brazos nor the great losses entailed by the overflow of the river.

The Brazos River proper heads in the Staked Plains of western Texas, in Hale and Lamb Counties, flows in a southeasterly direction, and empties into the Gulf of Mexico, draining an area of over 50,000 square miles. The stream in its entire length flows through a soft material, ranging from a black calcareous alluvial soil at the upper end to a sandy and clay loam representing reworked material in the lower parts. At the least sign of high water the river becomes a murky red and carries a large amount of silt. Although draining a very large territory, the river sometimes becomes very low, and the writer has waded it many a time during the dry season. Its main tributaries, the Little River and Little Brazos, have the same characteristics as the main stream and, though draining a smaller area than the main river, do great damage in times of overflow.

The overflows of the Brazos and results therefrom form an interesting study, but, unfortunately, until late years no accurate record has been kept of them. The first inundation of which even tradition speaks occurred in 1833, the next in 1843, and then one, of which there is more known, in 1852. This last appears to have covered immense areas of land and to have done great damage to stock, but facts are meager and unreliable, as might be expected, coming mostly in verbal form from old settlers. Between this flood and the next over 30 years elapsed, in which there was practically no high water, and the natives became careless and overconfident, so that the overflow of 1885 took them entirely by surprise. It seems as if the most damage in this case was done in the upper section, but no reliable reports can be obtained. The land in the lower section had not been cleared to any great extent up to this time, and therefore the damage was not as great as it might have been under other conditions.

What appears to have been the greatest and most general overflow of the Brazos, however, occurred in June and July, 1899. The year "99" is spoken of with awe by the natives and will long be remembered by them. Several years directly preceding 1899 were characterized by dry weather, and until June of that year the rainfall was barely normal. About May 20 excessive rainfall began to be reported all over the Brazos basin. At Anson, Jones County, the precipitation for June was 6.3 inches, against a 12-year average of about 2.4 inches. At Abilene, Taylor County, it was 5.45, average 3;

Panter, Hood County, 11, average, 3.7; Dublin, Erath County, 7.3, average, 2.8; Temple, Bell County, 11, average, 4.3; and like reports were received from stations all over the section. There were two distinct floods, but at such close interval that they are usually classed as one. The first reached its maximum on June 29, and the second on July 1. The average duration of this flood was about eight days, but in that time it covered an area of over 2,000 square miles and did damage to the extent of nearly $7,500,000. The greater damage was done in McLennan, Falls, Robertson, Brazos, Burleson, Grimes, Washington, Waller, Austin, Fort Bend, and Brazoria Counties. All the tributaries were out of their banks as well as the main stream, and the damage was appalling. The flood came at the period of the year when the greatest damage was possible, as none of the crops had been gathered, and it was too late to plant the second time, so that the crops of the season were nearly a complete loss. The damage to cotton was the greatest, amounting to about 226,950 bales. Corn followed, it being estimated that 4,366,000 bushels were destroyed. Besides these two important crops, great losses were sustained in other crops, live stock, building improvements, etc. The damage done to the land by washing was considerable, but this was offset by an increased richness of the soil from the deposit of silt. About 40 lives were lost by drowning, and according to a Government report hundreds of people were in a destitute condition, and large numbers were relieved by the generosity of landowners and public-spirited citizens. A great amount of sickness occurred directly after, malarial fever became prevalent, and the inhabitants underwent many hardships, but as a whole they rallied quickly and were soon back at work. The towns in the valley that depended upon the crops of the farmers suffered greatly and for a while business was almost paralyzed and great losses were the result. From these data the magnitude of the loss from this one flood can easily be seen. Within two weeks the water was out of its banks and back again, in the meantime having flooded 1,383,350 acres, caused a total loss of $7,412,543, ended 40 lives and paralyzed in a business way the entire section.

The next rise occurred in 1902, but did not amount to much. Six years then elapsed, and in May, 1908, the river again seriously threatened the farms. This time also there were two separate floods, but they occurred at a greater interval. About the 25th of April the crest of the first rise was reported at Kopperl, above Waco, and about May 1 it reached its greatest height at Booth, below Richmond. The second flood reached its maximum of 32 feet at Kopperl, on May 25; at Valley Junction, 51 feet, on May 27; at Hempstead, 43 feet, on June 1, and at Booth, 44 feet, on June 5. Ample warning was given the farmers in the lower section, and consequently little damage was done to stock, but the crops suffered heavily, especially in the second rise. There has been no estimate of the total loss as in 1899, for the overflow was not as general and widespread, but in some sections the crops were a complete loss. Late corn was planted after the waters receded, but did not do very well. In some parts cotton was replanted, but according to individual reports nothing was gained.

Within the last 10 years there has been a great amount of new land cleared and put under cultivation in this watershed, and the valuation has advanced considerably. All that is needed to make this one of the most profitable of farming districts is efficient protection against such overflows as those just mentioned. To accomplish this, a new interest is being taken in leveeing the river, and some progress has been made in the construction of levees.

Until the last year or two no systematic attempt has been made by planters to protect large areas, and the only work done was by individual parties here and there by constructing levees around their own property. A few levees were put up prior to the flood of 1899, but they proved ineffective, as they were mere earthen embankments thrown up in spare time for protection against slight rises, and were easily topped by the water. Later, others were erected which were but little better for protection against floods. The Sanger plantation, in Falls County, has had levees up for a number of years. The Wilson farm, in Robertson County, built levees about 1895, but both the rise of 1899 and that of 1908 went over them. In Brazos County the Rogers plantation built levees about 1905, but the second flood of 1908 topped them. Near Downsville, below Waco, embankments are being constructed by individual parties, under the supervision of engineers, which will likely prove effective, except in case of very high water. The Henderson farm, in Milam County, is also erecting a good embankment, but until 1910 no systematic attempt was made by the combined landowners in constructing levees.

In the appropriations of a former legislature $50,000 was set aside for levee and drainage purposes, and Mr Arthur Stiles, of the United States Geological Survey, was appointed State levee and drainage commissioner. The Federal Government added $50,000, and in cooperation with the State, in October, 1909, Mr. Stiles began preliminary surveys of the Brazos River from Sealy to Waco. Parties were kept in the field until May, 1910, and a considerable area was mapped preparatory to the location of the levees. Since then little has been done by the State, but Mr. Stiles hopes to begin operations again at an early date.

The most effective attempt at protection at present, however, is being done by the landowners. By forming into independent levee districts, taxing the land to be protected and issuing bonds, considerable territory is being put under protection.

Burleson County was the first to organize, and in the early part of 1910 let the contract for about 25 miles of levee. This was finished early in March, 1911. Brazos County followed, and in November, 1910, issued bonds to the value of $49,000, and awarded the contract for 12½ miles of levee, protecting 8,000 acres. This levee is to be finished by May, 1911. Washington County has lately formed a district and awarded the contract for 16 miles, protecting about 10,000 acres, at an estimated cost of $57,000. Efforts are being made to organize other districts which will undoubtedly be successful.

With the organization of these independent districts and with the cooperation of the Government the Brazos bottom will soon be a safe and productive section for the raising of crops. The changing of such an immense territory from a sickly, unsafe country to one of the most fertile sections of the State should attract the attention of the people at large, which it undoubtedly will do.